Scott M. Matheson
Governor

STATE OF UTAH
DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
150 West North Temple, P.O. Box 2500, Salt Lake City, Utah 84110-2500

Marv H. Maxell, Ph.D., Acting Director
Room 474 801-533-6121

James O. Mason, M.D., Dr.P.H.
Executive Director
801-533-6111

DIVISIONS
Community Health Services
Environmental Health
Family Health Services
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OFFICES
Administrative Services
Community Health Nursing
Management Planning
Medical Examiner
State Health Laboratory

September 21, 1982
533-6146

Mr. William L. Sharrer, Environmental Engineer
Geokinetics Inc.
582 North Vernal Avenue
P. O. Box 889
Vernal, UT 84078

RE: Construction Permit
Process Wastewater
Evaporation Pond #2

Dear Mr. Sharrer:

We have reviewed the plans and design criteria for the proposed additional process wastewater evaporation pond at your research and development shale oil production unit in Southern Uintah County, Utah.

As a result of our review we find the plans to be in substantial conformance with the Utah Wastewater Disposal Regulations and a construction permit as constituted by this letter is hereby issued for the following.

1. The proposed pond will be 330 feet square, 7 feet deep with 3:1 internal embankment slopes. It will contain approximately 5 million gallons of water allowing for a 25 percent margin of safety at an annual net evaporation rate of 31 inches during the period of extra shale oil production.

2. To prevent any possible contamination of the adjacent area the pond will be lined with a 36 mil oil resistant chlorinated reinforced polyethylene material.

   A leak detection system will consist of a network of perforated PVC pipe in gravel-filled trenches underneath the pond and channeled to the outer perimeter of the pond and collected in a sump outside the pond. Periodic inspections of the sump will be made to monitor the performance of the liner. Any leak will be sealed immediately after transferring the water to the existing pond.

RECEIVED
MAR 04 1983
DIVISION OF
OIL, GAS & MINING

Sincerely,

UTAH WATER POLLUTION CONTROL COMMITTEE

Calvin K. Sudweeks
Executive Secretary

EHP:db
cc: Rand Webb/Uintah Basin Department of Health

An Equal Opportunity Employer

GEOKINETICS INC. shale oil development and production

582 north vernal avenue • p.o. box 889 • vernal, utah 84078 • telephone (801) 789-0806

August 31, 1982

Mr. Calvin K. Sudweeks
Executive Secretary
Utah Water Pollution Committee
150 West North Temple
Salt Lake City, UT 84103

Dear Mr. Sudweeks:

Geokinetics Inc. is proposing to expand its in-situ retort research and development project during the next year. This expansion includes an increase in shale oil production which will also increase the production of process wastewater. Geokinetics' plans are to dispose of this wastewater by means of evaporation ponds; however, the storage capacity of our present pond (42,500 bbls.) will not handle this increased production. Therefore, Geokinetics Inc. is requesting that the Utah Water Pollution Control Committee grant Geokinetics a construction permit to install an additional evaporation pond at its research site.

Enclosed are the proposed plans for the pond including: the design, construction and leak detection system.

Geokinetics respectfully submits this information for your review and consideration. Should you require any additional information, please feel free to contact us at 801-646-3401.

Sincerely,

William L. Sharrer

William L. Sharrer
Environmental Engineer

WS/ks

Enclosures (10)

RECEIVED
MAR 04 1983
DIVISION OF
OIL, GAS & MINING

EVAPORATION POND PLANS

Enclosed are the proposed plans, specifications, and other pertenent information for the installation of an evaporation pond for which Geokinetics requires a construction permit.

Design

The pond will be required for a period of twelve (12) months, December 1, 1982 to November 30, 1983. During this period, approximately 133,900 barrels (751,790 cu. ft.) of process wastewater will be produced and require disposal (Table 1). A current chemical characterization of the water is shown in Table 2.

In order to adequately handle this volume, the following pond design parameters are proposed (Figure 2).

- Area - 2.5 acres
- Depth - 7.0 feet
- Slope - 3:1

The pond size was estimated using a water balance method (Table 3) which incorporated long-term climatological data (Table 4) and conservative estimates of pond evaporation. This method was used in lieu of energy balance techniques since the pond would be needed for only a limited period of time.

The proposed design will result in a volume capacity of 119,225 barrels (669,400 cu. ft.) and will allow for a 25 percent margin of safety at an annual net evaporation rate of 31 inches.

In addition to the proposed pond, an existing evaporation pond with a capacity of 42,500 barrels will be available as a backup facility during this twelve month period.

Surface accummulations of liquid and/or solid hydrocarbons will be kept at a minimum with the use of oil-water separators and pond skimming devices.

A wire mesh fence of sufficient height to prevent the access of large animals into the pond, will be constructed around the perimeter of the pond.

Location

The proposed pond will be located adjacent to the existing wastewater impoundment to facilitate the use of both ponds (Figure 4). The site is well removed from surface water channels and along with the present pond, covers a major portion of the surface drainage area. However, a drainage network will be constructed to divert any surface waters away from the ponds, should runoff occur.

The nearest aquifer to the pond site is located in the Douglas Creek member of the Green River Formation, approximately 900 feet below the surface. A small amount of shallow perched groundwater does occur on-site, however it is highly mineralized and of very poor quality.

More information pertaining to the site hydrology and geology can be found in the "Hydrologic and Geologic Characterization of the Geokinetics Seep Ridge Site" by Law Engineering. (This report was presented to your office under a previous request).

Additional plans for the construction of the pond include an artificial liner and leak detection system.

Pond Liner

The proposed pond will be lined with an oil-resistant chlorinated polyethylene reinforced (CPER-OR) material manufactured by Wastesaver Company, Inc. of Denver, Colorado. The material has a thickness of 36 mil (0.036 in.) and is resistant to oil, alkalis, ultraviolet light, and is of suitable strength to withstand tears or punctures.

The liner will be installed over a 2 to 3 inch layer of fine-grained soil to prevent punctures or tears caused by underlying rock.

To prevent wear to the liner from the force of the discharge water, a protective apron will be placed on the inside of the dike below the discharge inlet.

To insure proper installation, the liner will be laid according to the manufacturers specifications while under the supervision of one of their representatives.

Leak Detection System

The leak detection system will consist of a network of perforated PVC pipe at near right angles to the natural dip of the shallow bedrock (Figure 5). The pipe will be contained within gravel-filled trenches channeled to the outer perimeter of the pond and collected in a sump outside the pond. Periodic inspections of the sump will be made to monitor the performance of the liner.

Should a leak occur, measures will be taken to seal the leak immediately, utilizing materials suggested by the manufacturer. To facilitate this effort, as much water as possible will be transfered to the existing pond and any available storage tanks.

TABLE 1.

PROJECTED WATER PRODUCTION BETWEEN
SEPTEMBER 1, 1982 AND MARCH 31, 1984
(in barrels)

DATE	DAILY PRODUCTION	MONTHLY PRODUCTION	
SEP	100	3,000	
OCT	100	3,100	
NOV	100	3,000	
DEC	300	9,300	
JAN	300	9,300	
FEB	300	8,400	Production
MAR	300	9,300	increase where
APR	400	12,000	an additional
MAY	400	12,400	pond is
JUN	400	12,000	required.
JUL	400	12,400	(133,900 bbls)
AUG	400	12,400	
SEP	400	12,000	
OCT	400	12,400	
NOV	400	12,000	
DEC	200	6,200	
JAN	200	6,200	
FEB	200	5,800	
MAR	200	6,200	
	TOTAL	167,400 BBLS.	

FIGURE 1 – PROPOSED PERIOD OF INCREASED WATER PRODUCTION

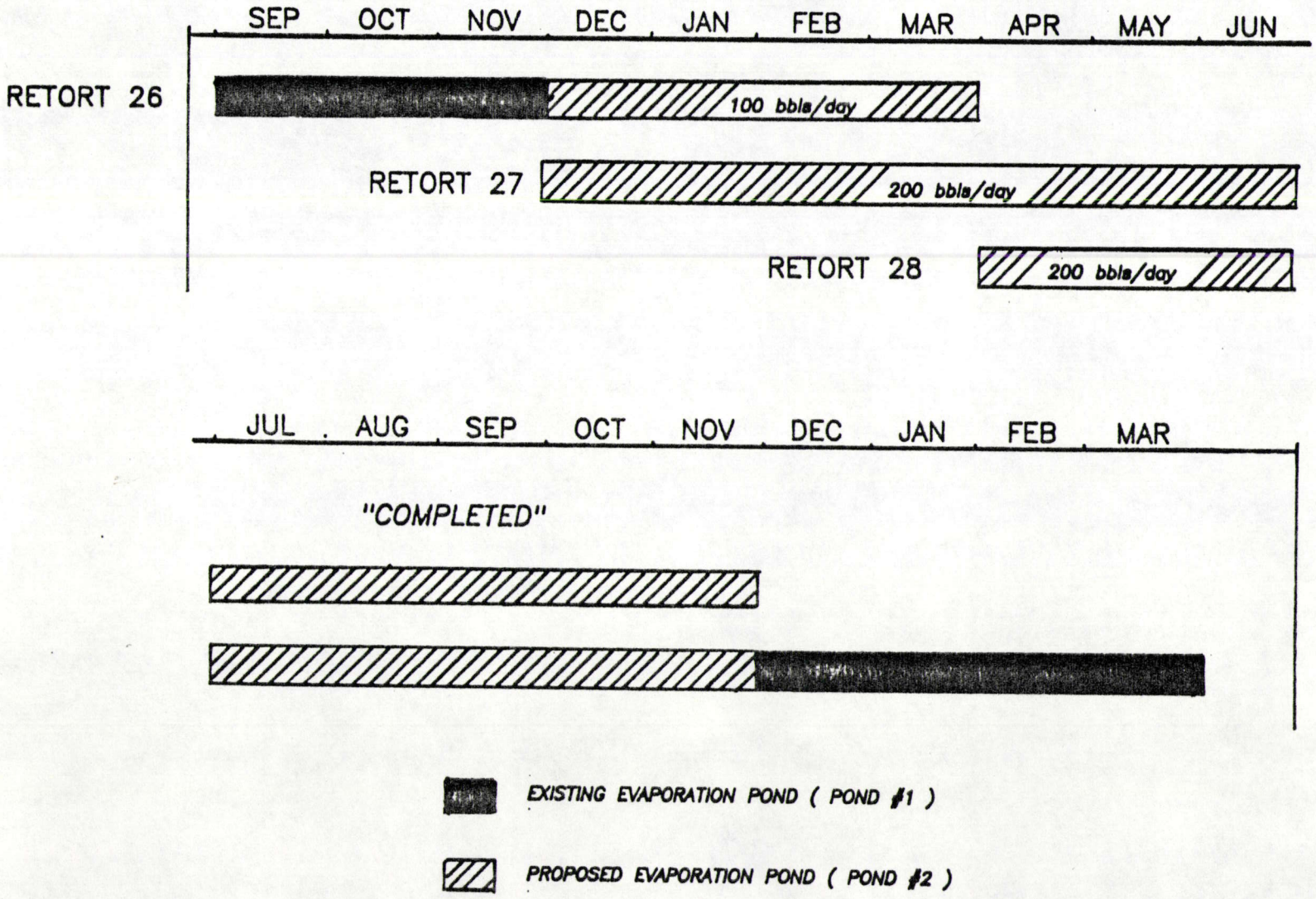
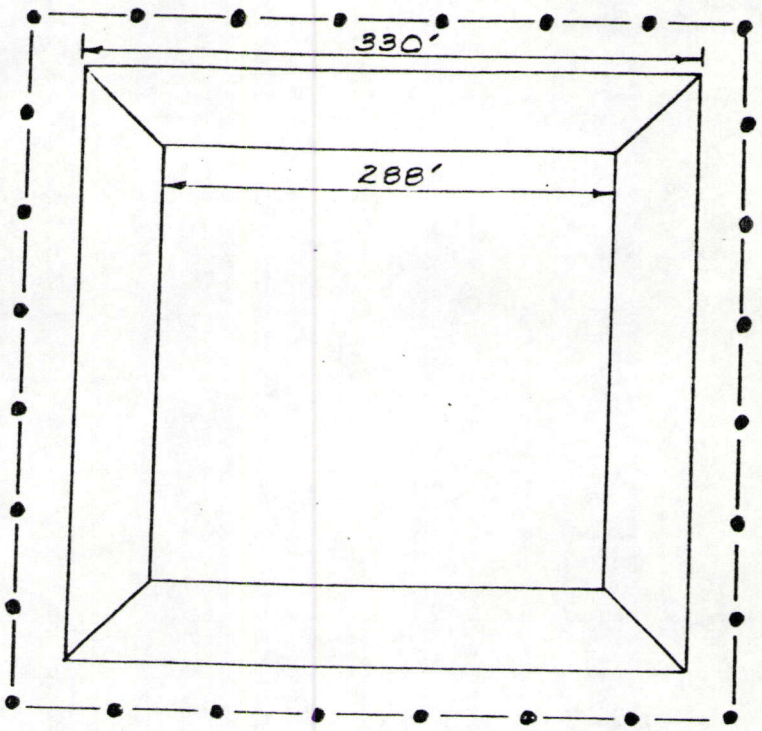


TABLE 2

RETORT #25 PROCESS WATER QUALITY
Based On n=5 Unless Otherwise Noted
All Concentrations Expressed As Mg/l,
Unless Otherwise Noted

PARAMETER	n-SIZE	MEAN	STD. DEV.	MIN.	MAX.
Sodium		4,886	2,483	2,924	9,036
Potassium		103.5	55.3	65.3	196.0
Magnesium		4.5	1.7	3.6	6.2
Calcium		7.8	3.1	7.4	4.5
Strontium		1.6	0.8	0.9	2.8
Fluoride		24.1	9.5	8.3	33.0
Chloride		944	325	510	1,328
Bromide		4	2	2	5
Phosphate		8	4	3	10
Nitrate		118	72	5	419
Sulfate		393	178	159	616
Bicarbonate		14,584	2,989	11,660	19,099
Carbonate		2,747	789	1,723	3,616
Antimony		0.39	0.22	0.20	0.47
Arsenic	4	27.11	9.15	15.31	37,63
Boron		354	109	223	522
Iron	4	1.35	0.71	0.48	2.05
Lead		0.072	0.049	0.05	0.16
Silicon		6.2	1.2	5.1	8.1
Molybdenum		1.85	1.32	0.74	4.13
Selenium	4	0.015	0.003	0.013	0.019
Oil & Grease		287	79	200	400
Phenols		58	20	27	80
TOC	4	1,816	190	1,533	2,063
TKN	4	4,352	896	3,515	5,480
BOD	4	2,140	454	1,512	2,598
Ammonia		1,036	294	640	1,439
Ammonium		2,674	608	1,760	3,360
Cyanide		73.5	87.0	20.2	227.0
Sulfide	3	150	74	65	197
Thiocyanate		303	114	178	432
Thiosulfate		2,137	744	1,281	3,081
Alkalinity		16,535	2,622	12,430	19,568
COD		7,355	2,938	2,410	9,565
TIC	4	2,465	342	2,155	2,821
Conductivity umhos·cm^{-1}		18,620	1,526	16,800	20,900
pH units		9.08	0.16	8.92	9.27
TDS		16,117	6,809	9,857	27,100
TSS	4	122.8	87.3	32.3	208.7

POND LAYOUT



CROSS SECTION

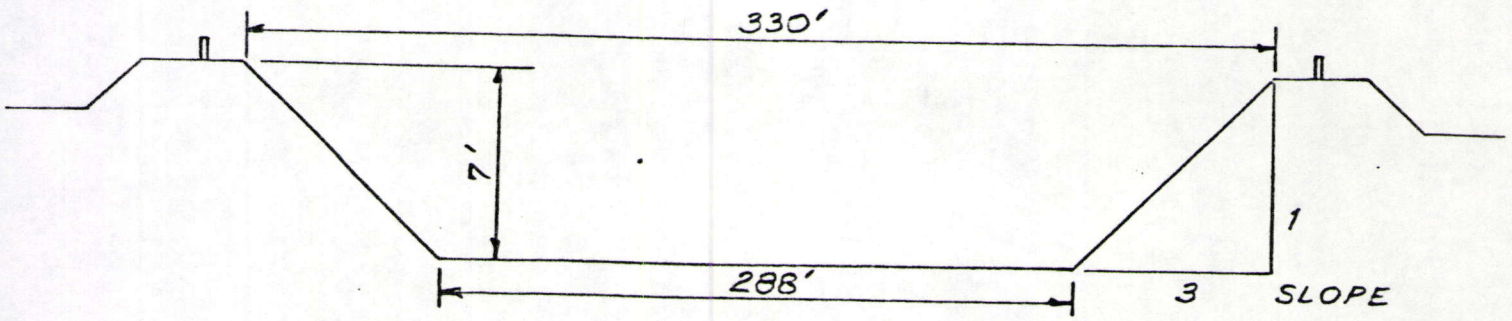


FIGURE 2

SCALE: NONE

TABLE 3. WATER-BALANCE DETERMINATION
(all values expressed in barrels)

DATE	PRODUCTION	− NET EVAPORATION[1] (Pond 1	+ Pond 2)	= TOTAL (Accumlative) (Pond 1	+ Pond 2)
AUG				9,850	--
SEP	3,000	4,800	--	8,050	--
OCT	3,100	1,450	--	9,700	--
NOV	3,000	-750	--	13,450	--
DEC	9,300	-550	-850	14,000	10,150
JAN 83	9,300	-650	-950	14,650	20,400
FEB	8,400	-750	-1,100	15,400	29,900
MAR	9,300	-1,100	-1,650	16,500	40,850
APR	12,000	2,350	3,700	14,150	49,150
MAY	12,400	5,300	8,550	8,850	53,000
JUN	12,000	7,000	10,250	1,850	54,750
JUL	12,400	1,850	10,200	0	56,950
AUG	12,400	--	8,050	--	61,300
SEP	12,000	--	6,500	--	66,750
OCT	12,400	--	2,500	--	76,650
NOV	12,000	--	-1,350	--	90,000
DEC	6,200	-500	-950	6,700	90,950
JAN 84	6,200	-600	-1,150	13,500	92,100
FEB	5,800	-750	-1,300	20,050	93,400
MAR	6,200	-1,100	-1,900	27,350	95,300
TOTAL	167,400	16,000	38,600	27,350	95,300

Pond 1: Existing Pond
Pond 2: Proposed Pond

1) Monthly net pond evaporation was estimated using the previous months level (or surface area).

TABLE 3 (continued)

Calculations

$$\text{Balance} = \Sigma\text{Prod} - \Sigma\text{Net Evap} + \text{Storage}$$

$$= 167{,}400 - 54{,}600 + 9{,}850$$

$$122{,}650 = 122{,}650$$

(Pre-balance determination)

$$Ak = \frac{F\ (525{,}600)}{(7.48)(43{,}560)} \cdot \frac{1}{D/X} + \frac{1}{EV/12}$$

$$= \frac{10.70\ (525{,}600)}{(7.48)(43{,}560)} \cdot \frac{1}{7/1} + \frac{1}{31/12}$$

$$= 1.8 \text{ acres}^{1} \cdot (1.4) = 2.5 \text{ acres @ } 7.0 \text{ feet}$$

where D = depth of water in pond (ft.)

Ak = acres

F = inflow (gpm)

Ev = net evaporation (in/yr)

X = years

1) This value represents an estimate of pond size requirements. However, from past pond design experience, using water balance techniques, this value underestimates the pond size. A factor between 1.3 and 1.6 (depending upon the pond size) is used to adequately allow for margins of error or any contingency.

FIGURE 3 - STORAGE CURVE

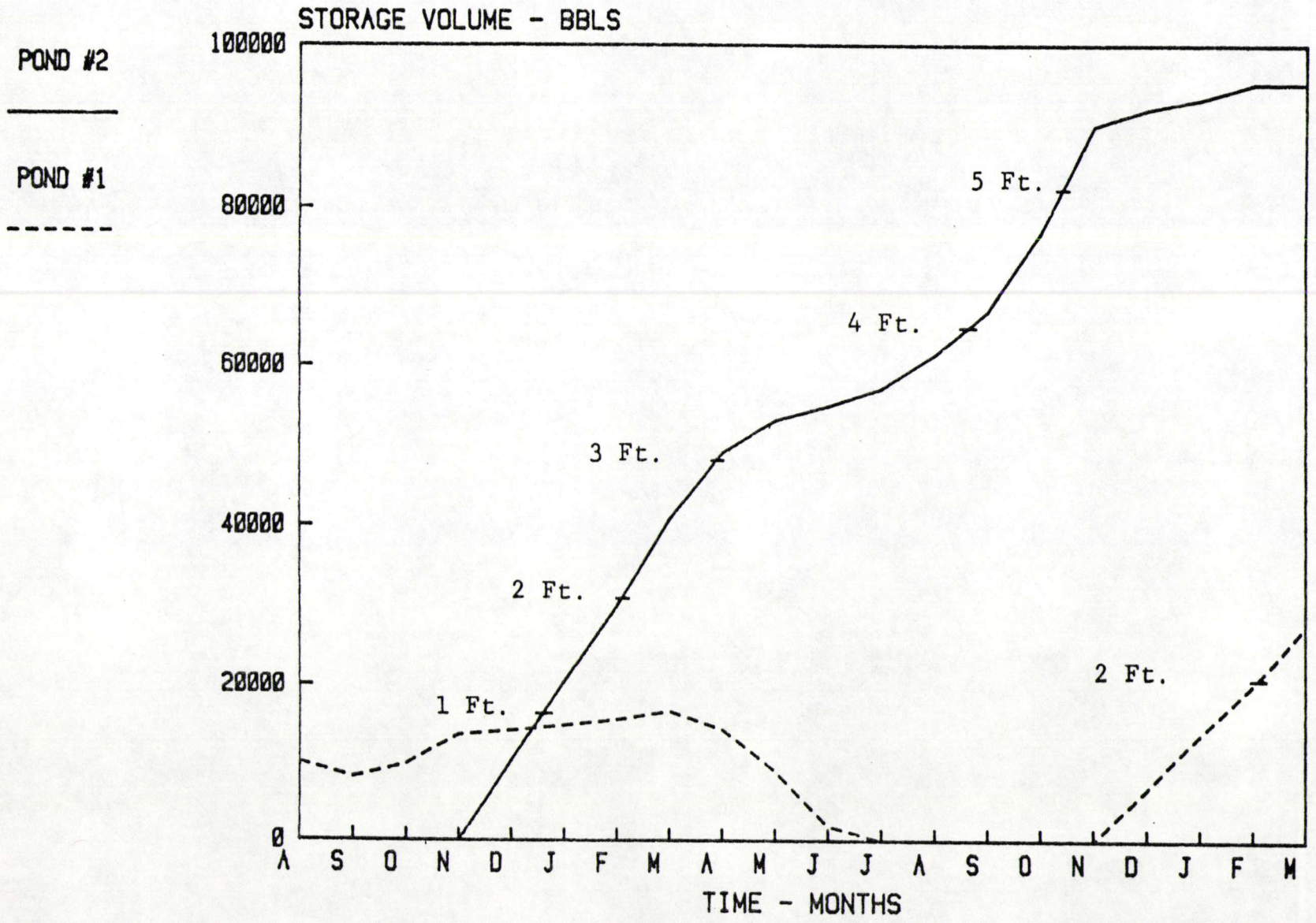


TABLE 4. CLIMATOLOGICAL DATA
(all values expressed in inches)

DATE	EVAPORATION [1]	PRECIPITATION [2]	NET EVAPORATION
OCT	3.13	1.41	1.72
NOV	--	0.91	-0.91
DEC	--	0.62	-0.62
JAN	--	0.75	-0.75
FEB	--	0.85	-0.85
MAR	--	1.24	-1.24
APR	3.72	1.01	2.71
MAY	7.36	1.20	6.16
JUN	8.00	0.71	7.29
JUL	8.59	1.35	7.24
AUG	7.25	1.56	5.69
SEP	5.72	1.15	4.57
TOTAL	43.77	12.76	31.01 [3]

1. Average monthly pan evaporation at Ft. Duchesne, UT (34 year record).

2. Average monthly precipitaton at Mayo Cabin Uintah Co., UT. (18 year record) (1 mi. from Geokinetics development site).

3. This value is considered conservative since a three-year study of on site evaporation using process water, resulted in an annual net evaporation rate of 39.46 inches.

FIGURE 4 – POND LOCATION

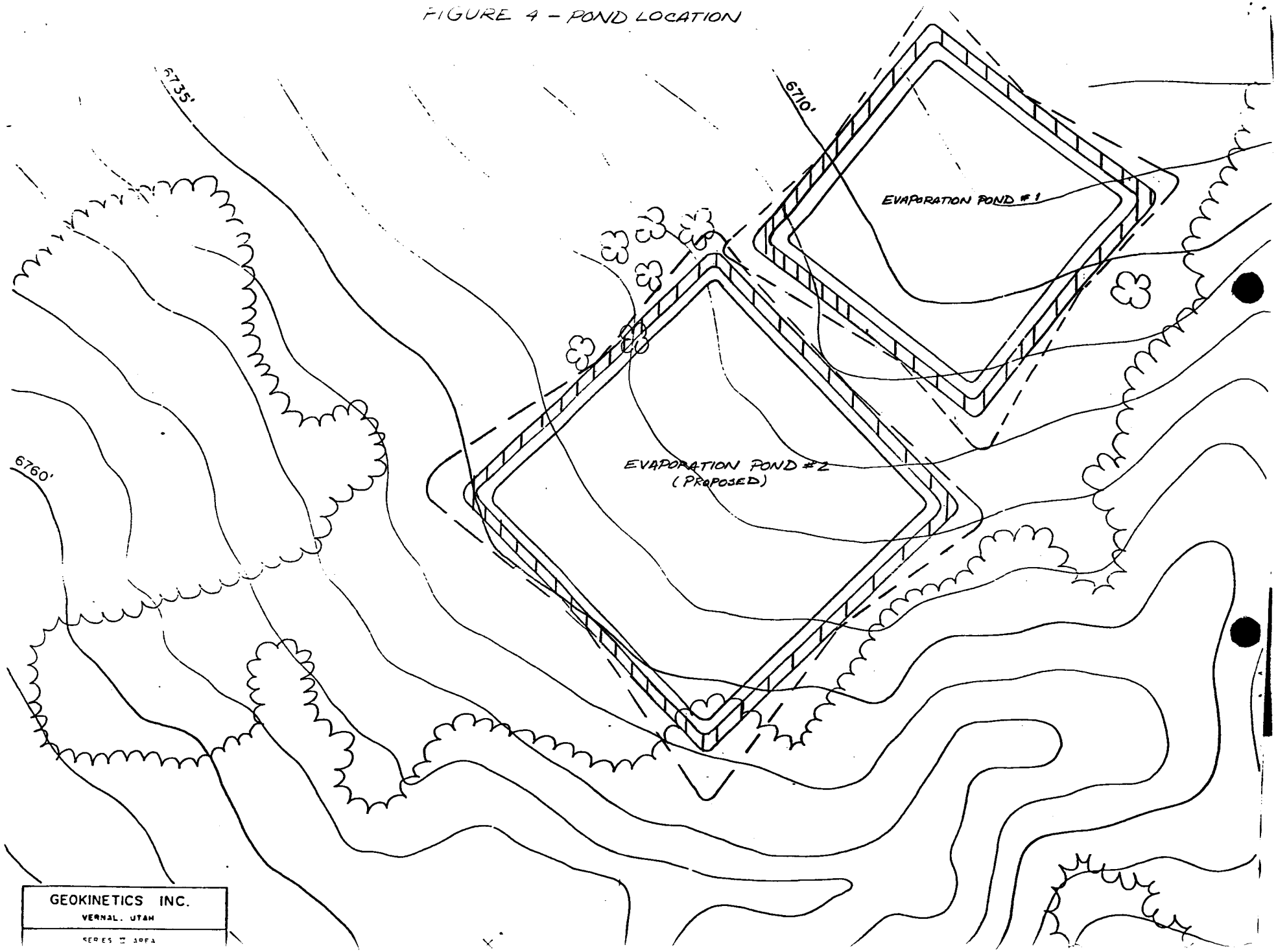


FIGURE 5

LEAK DETECTION SYSTEM